DEV-2420

Digital Encrypted Voice
Communication Device

V 1.0

User's Manual

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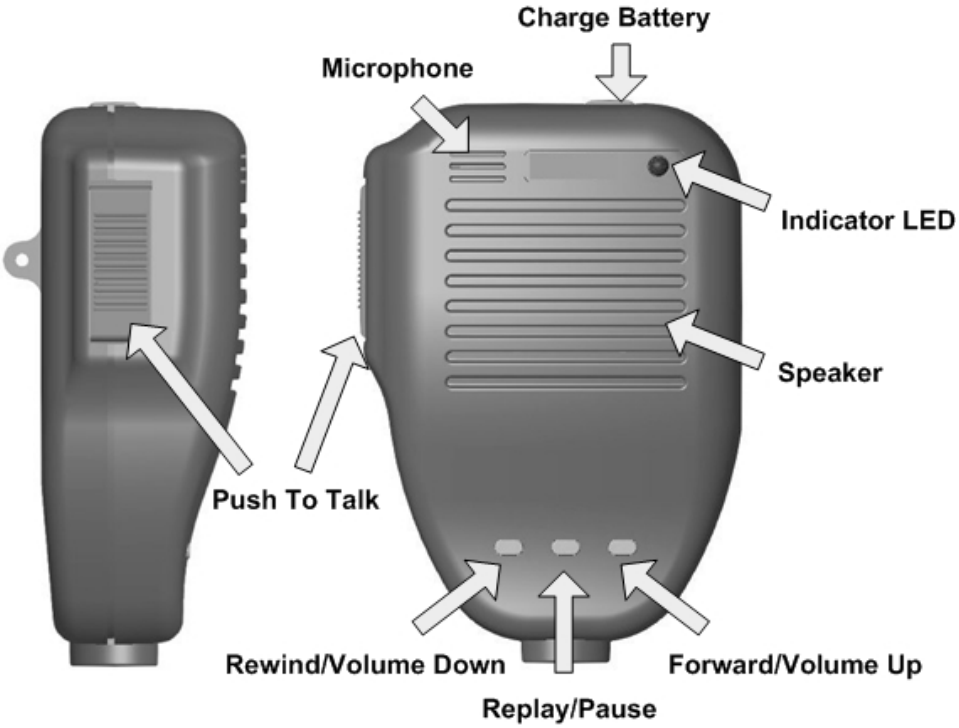
Overview



I. Introduction

DEV-2420 was designed to provide a conventional two-way VHF/UHF radio with an inexpensive digital encrypted voice communication capability. With this device, customers not only upgrade their voice communication quality from analog to digital, but have the added advantage of encrypting voice through advanced digital encryption computation

DEV-2420 carries out its voice compression via multi-band excitation (MBE) coding, which provides high compression with very good voice quality. Field tests show that with this device, a user can clearly differentiate the distinct traits that distinguish individual voices. The MOS (Mean Opinion Score) of the voice quality of DEV-2420 is about 3.0, when the voice is compressed down to 2000 bps.

DEV-2420's encryption is achieved via a highly complex nonlinear serial scheme with a default 128-bit key length (optional 256-bit version can be provided upon request). At the design stage, DEV-2420 takes into consideration the interference among various radios. To minimize this problem, MSK modulation is adopted to achieve high tolerance to interference. The 2400 bps transmission speed functions well within 12.5 KHz channel capacity.

By digitizing voice, DEV-2420 is capable of real time recording. During the communication, it stores the digitized voice in a Flash memory IC. Users can retrieve and listen to this content via a special key on the board. Two recording lengths are available, 50 minutes and 3.5 hours. Designed to work with handheld radios, DEV-2420 is also equipped with a rechargeable Li-Ion battery and power management module to deal with the issue of power source unavailability.

Meanwhile, optional modules are available to further enhance DEV-2420 as needed for your operations. As position fixed is the most demanded capability for mobile communication, DEV-2420 offers an optional GPS module that is small and lightweight, and features high sensitivity, high reliability, and low power consumption. A special mini, all-directional antenna is designed for this module. With this GPS module, every time PTT (Push to Talk) is pressed, DEV-2420 will automatically send out the position information after the voice communication is completed. The position information is thereby recorded along with the communication.

For special applications such as fixed route patrol, DEV-2420 also offers a RFID reader module option that is an integral part of the RFID based Electronic Patrol Management System (EPMS). With this option (Section 13), users can read the RFID information placed on the patrol location and send back all patrol information to headquarters for patrol management. This option is exclusive of the GPS option, i.e. they cannot be available at the same time.

I.1 Package

Your package should contain the items in the following table. Upon opening the package, if you find any item missing, please notify your distributor immediately.

Item	Content	QNT
Standard Package		
1	Main DEV-2420 Unit	1
2	User's manual	1
3	Quick start	1
Option		
1	AC Charger	1
2	Connector	1

I.2 Notices

- Fully charge your battery, before your first operation
- Please make sure you have the right type of DEV-2420 for your radio. RITI Technology Inc. will not be responsible for the damage on either DEV-2420 or your two way radio, if it is caused by the miss-use of incompatible unit.
- **Please turn off the radio's compander function, before your first operation. For compander function related information, please contact your local radio distributor.**
- Please observe any safety regulations related to the operation of two-way radio, when using our device.
- This product should only be serviced by trained personnel approved by RITI Technology Inc., who will not be responsible for the damaged caused by the unauthorized maintenance.

I.3 Warranty

The warranty period for this product is one year, but it will not cover the following:

- Damaged caused by improper use of this product
- Do not operate this product according to this manual
- Not maintained or repaired by personnel authorized personnel .
- Damaged by events such as fire, flood and others caused by mother nature
- Damaged by improper transportation

I.4 Battery

When battery is low, the unit will beep every 10 seconds. . The battery needs to be charged by charger supplied with the package. To charge, please open the protective cap on the charging hole at the top and plug the charger into any 100~240 volt AC outlet. During the charging, the indicator light (LED) blinks twice every 3 second in green. When charge is complete, the blink becomes slower (once every 3 seconds)

Figure. I.1 Charging DEV-2420

Note: Do not use the charger to charge the DEV-2420, when it is connected to the radio.

II. Operating your DEV-2420

II.1 Connecting to your radio

- Please turn off the radio's COMPANDER function, before connecting to your radio.
- Please check carefully, if you have the right type of product compatible with your radio. The device could be damaged by the use of incompatible type.

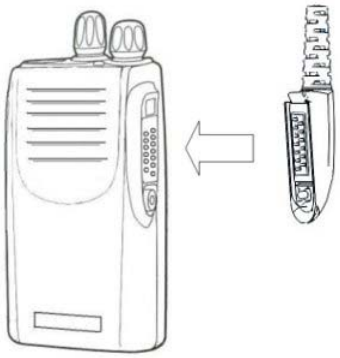


Fig. II.1 connecting to 2 way radio

- Open the protective cap of the connector on the right side of the radio, and screw tightly the DEV-2420 cable to it (Fig. II.1).
- The device is in stand-by mode, if the indicator light blinks once every 3

seconds in green or twice in 3 seconds (radio is charging the DEV-2420).

- Turn the radio to the designated frequency, and DEV-2420 is ready to use.

II.2 Ready to communicate[1]

- **TALK**: Pressing the "Push to Talk" button and waiting for ready tones (a long "du" sound) to stop, you are ready to talk. The best result is to hold the DEV 2420 2.5 cm to 5 cm away from your mouth. When talking, the Indicator Light stays in red.
- **LISTEN**: When you hear someone calling you, the Indicator Light turns green.
- **RECORD**: With recording option, every incoming or outgoing communication section will be recorded automatically. The amount of recording depends on the option you purchased (up to 3 hours and 30 minutes).
- **VOLUME**: You can only control the volume, when the device is in **standby** or **listening** modes. Press (more than 0.1 second) "Rewind/Volume Down" and "Forward/Volume Up" buttons to control your volume. The volume is divided into 7 grades.
- **REPLAY**: When "Replay" button is pressed for more than 3 seconds, DEV-2420 will replay the recorded communication starting from the beginning of the last section, if the section is less than 1 minute and 30 seconds or the beginning of the section containing this 1 minute 30 second marker. Press "Rewind/Volume Down" or "Forward/Volume Up" buttons to move recording backward or ahead one section. To stop, press "Reply/Pause" button

Note: When battery-low-voltage alerts ("dududu" sound every 10 seconds), DEV-2420 will stop transmitting, receiving and recording functions. If you press PTT button at that time, the "dududu" sound will become every 2 seconds.

III. System Operations

Two radios equipped with DEV-2420's can communicate with each other. Base station DEV-2420-BS, which has the same voice encryption and digitization functions with1U frame size, can be used to communicate with a DEV-2420 equipped radio. There is a RS232 port on DEV-2420-BS to communicate with a base station PC for applications.

DEV-2420 can be expanded to receive GPS location data or RFID data, which are mutually exclusive, for location based applications such as mobile resource management and electronic patrol management system (EPMS). For mobile resource management application, location data will be sent every 2 second back to the base station PC via DEV-2420-BS during the "talk" mode. Thus, the location of the mobile resource can be tracked

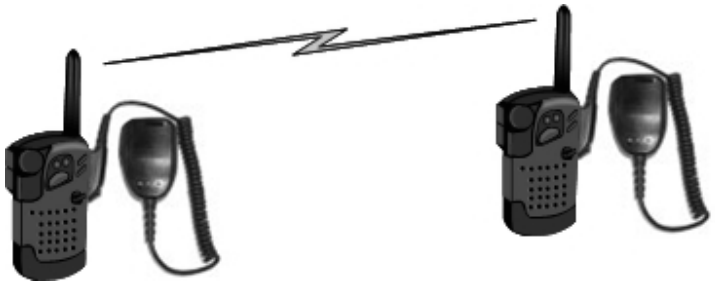
[1] Since communication (talk or listen) vis DEV-2420 is digitized and encrypted automatically, only users with the same authorized encrypted key can communicate with each other.

dynamically or stored as history data. For EPMS application, a RFID reader is included in the DEV-2420. By posting RFID card at each patrol location, the patrol status can be recorded dynamically, transmitted via DEV-2420 and monitored by the base station PC. If you are interested in these applications, please contact us for more detailed briefing.

The technical specs are given in Section IV. In the following sub-sections, three possible configurations are presented.

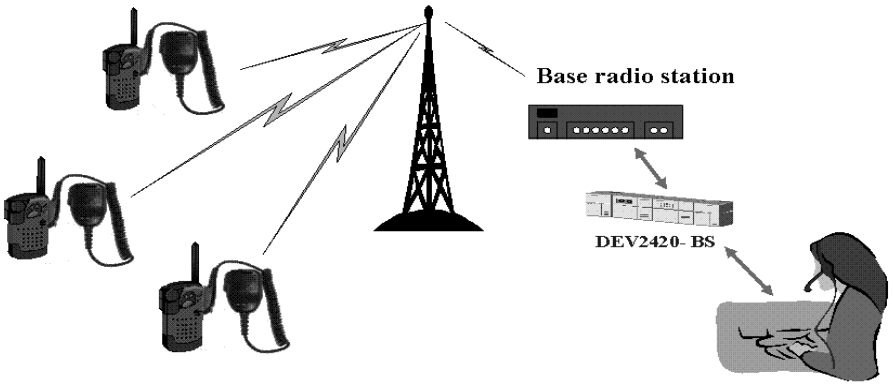
III.1 radio to radio:

Communicate between radios with encrypted digital voice communication only



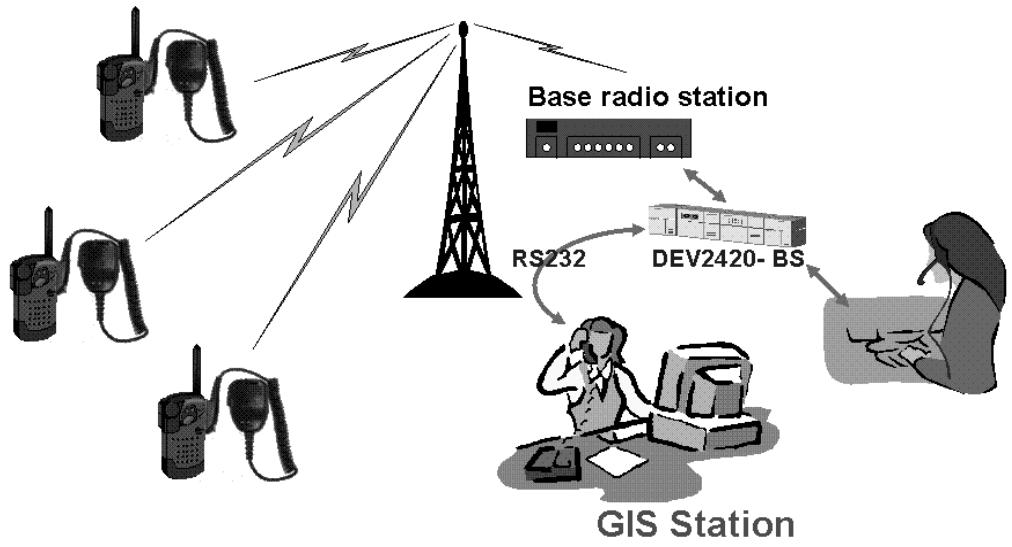
III.2 radio to/from a base station:

Communicate between a base station and radios with encrypted digital voice communication



III.3 Radio to/from a location based base station

Communicate between a base station and radios for both encrypted digital voice communication and location-based applications or EPMS applications.



IV. Technical Specifications

GENERAL		VOICE/ENCRYPTION	
Power source *	3.7V/320mA Li-Ion Battery	Voice compression	**M**ulti-**B**and **E**xcitation
Battery time *	12hours@1:1:8 (TX=1 RX=1 Stb=8)	Compression rate	2000bps
Working temp	-10℃ ~ 80℃	Encoder Delay	43.5mS
MIC sensitivity	-45dB @30cm	Decoder Delay	17.5mS
Audio Output	power 1.2W @ 8Ω	Synchronized time	450mS
LED instruction	PTT PLAY CHARGE	MOS	3.0
Working format	half duplex	Encryption computation	complex nonlinear series
Modulation	MSK	Key length	128bit (default)or 256bit (optional)

TX Data rate	2400bps	Key change	new key after every communication
Bit Error Rate	1.5X10-3@SNR=12dB	GPS receiver*	
Individual ID	(CID)2^{16}	Frequency	1575.42MHz
System ID	(SID)2^{14}	Channels	12
Frame sync. cycle	~ 2seconds	Start	< 43 sec (Cold) < 3 sec (Hot)
Frame sync. accuracy rate	greater than 0.999 , when error code rate is less than 1×10^{-2}	Antenna	Omni Antenna
Error correction	every 20byte interleave coding, or 20 bit of sudden error can be corrected, or every 3 random errors, under 6 random errors could be corrected with higher than 0.99 probability.	RFID Reader*	
		Frequency	125KHz
		Reading Range	7~10cm
		Transponder	Read Only

* Options

V. Trouble Shooting

Problem	Possible solutions
The receiver can't hear your voice	1. Check if receiving end also equipped with our DEV product 2. Make sure radios tune at the same frequency 3. Make sure you have turned off the radio's COMPANDER function. 4. make sure you and your receiver belong to the same authorized group
Poor communication quality	1. check if you are within the limit of the radio reception area or in a poor reception area 2. check if your radio battery running low. If so, please recharge it 3. if DEV-2420 beeps 3 times in every 10 second, you will need to recharge your battery 4. Make sure you have turned off the radio's COMPANDER function.
The beginning portion of the voice recording get cut off	After you press "Push to Talk" , please wait for "du.." sound before you talk.
No response after key is pressed	Make sure you need to press the key for more than 0.1 second and the replay button needs 3 seconds.

Note:
If you can't solve your problem, please contact us.

VI. Entire DEV-2420 product line

P/N	Description
2420-N-S-NC-00	connecting cable included without any option*
2420-B-S-NC-05	2420-N-S-NC-00 plus Li-Ion battery, 50 minutes voice recording
2420-B-G-NC-05	2420-B-S-NC-05 plus GPS, Omni Antenna
2420-B-R-NC-05	2420-B-S-NC-05 plus RFID reader option
2420-X-X-XX-35	Increasing voice recording time up to 3 hours and 30 minutes (2420-B-S-NC-05, 2420-B-G-NC-05, 2420-B-R-NC-05)
2420-X-X-G3-XX	Motorola GP328/338 connecting socket set
DEV-2420-BS	Base station for DEV series, including audio balance input and output and RS-232 data port to computer

Options:
Li-Ion battery, voice recording, GPS with Omni Antenna, RFID reader option, Motorola GP328/338 connecting socket set